beyond the depth of the upper portion of the waste chamber so that it protrudes into the lower portion of the waste chamber. Preferably the height of the anti-foaming web is selected to achieve optimum anti-foaming by allowing the flow of liquid under the web/wall but blocking the flow of bubbles above the surface of the liquid in the waste chamber.

[0221] Yet another anti-foaming/bubbling measure is to include an anti-foam agent in the waste chamber or in another conduit or chamber of the cartridge so that liquid entering the waste chamber has less propensity to foam and/or form bubbles.

[0222] The detection chambers are adapted for carrying out a physical measurement on the sample. The detection chamber is connected to an inlet conduit. Preferably, the detection chamber is also connected to an outlet conduit and is arranged as a flow cell. If the measurement requires illumination or optical observation of the sample (e.g., as in measurements of light absorbance, photoluminescence, reflectance, chemiluminescence, electrochemiluminescence, light scattering and the like) the detection chamber should have at least one transparent wall arranged so as to allow the illumination and/or observation. When employed in solid phase binding assays, the detection chamber preferably comprises a surface (preferably, a wall of the chamber) that has one or more binding reagents (e.g., antibodies, proteins, receptors, ligands, haptens, nucleic acids, etc.) immobilized thereon (preferably, an array of immobilized binding reagents, most preferably an array of immobilized antibodies and/or nucleic acids). In an especially preferred embodiment, the detection chamber is an electrochemiluminescence detection chamber as described above, most preferably having one or binding reagents immobilized on one or more electrodes. In one preferred embodiment, the cartridge comprises a working electrode having an array of binding reagents immobilized thereon. In another preferred embodiment, the cartridge comprises an array of independently controllable working electrodes each having a binding reagent immobilized thereon, Preferably, in cartridges employing arrays of binding reagents, at least two elements of the array comprise binding reagents that differ in specificity for analytes of interest. Suitable detection chambers, electrode arrays and arrays of immobilized binding reagents for use in ECL-based cartridge systems are described in detail above and include the embodiments shown in FIGS. **1-4**.

[0223] The detection chamber is, preferably, arranged in an elongated flow cell design with inlet and outlets at or near opposing ends of the elongated dimension. Depending on the application, manufacturing approach, sample size, etc., the flow cell dimensions can range from nanometers to tens of centimeters and the volume from picoliters to milliliters. Certain preferred embodiment have widths that can range from 0.05-20 mm, more preferably, 1-5 mm and heights (preferably, less than or equal to the width so as to increase, for a given volume, the surface area of the bottom of the detection chamber, especially when this surface is used to immobilize binding reagents) that range from 0.01-20 mm, more preferably, 0.05-0.2 mm. Preferably, the height is less than or equal to the width. Preferably, the detection chamber is designed to accommodate sample volumes between 0.1-1000 uL, more preferably, 1-200 uL, more preferably, 2-50 uL, most preferably, 5-25 uL. In embodiments that are limited by sample volume (e.g., cartridges measuring blood from finger pricks), especially preferred detection chamber volumes are less than 10 uL, more preferably 0.5-10 uL, even more preferably 2-6 uL. The flow cell preferably has a width greater than or equal to the height.

[0224] A cartridge may comprise one or more detection chambers. Cartridges comprising multiple detection chambers may comprise separate fluidic systems for each detection chamber (e.g., multiple sample chambers and/or reagent chambers and associated fluidic conduits) so that assays on multiple samples may be carried out in parallel. In certain preferred embodiments, multiple detection chambers are linked to a single sample chamber and may share the use of other fluidic components such as reagent chambers, waste chambers and the like. In these embodiments, the two detection chambers may be used to carry out different sets of assays, thus increasing the number of measurements that can be carried out on a sample relative to a cartridge with one detection chamber. Advantageously, the use of multiple detection chambers allows for carrying out in a single cartridge multiple incompatible measurements, that is measurements that can not be performed in a single reaction volume or benefit from being carried out in separate reaction volumes, e.g., measurements that have different requirements for pH or assay composition or otherwise negatively interfere with each other.

[0225] In an alternate embodiment employing a plurality of detection chambers, one or more of a plurality of detection chambers is used as control/calibration chamber for measuring assay control/calibration samples. In one such embodiment, a first and a second detection chamber are each configured to carry out a panel of one or more assays for one or more analytes. One detection chamber (the test chamber) is used to analyze a sample. The other detection chamber (the control chamber) is used to analyze a spiked sample having a predetermined additional amount of the one or more of the analytes of interest (this predetermined additional amount, preferably, being provided by passing the sample through a reagent pill zone comprising the additional amounts). The change in signal between the two chambers allows for the calculation of the responsiveness of the signal to changes in analyte and can be used to calibrate the system and/or to determine if the cartridge is functioning properly. In another embodiment employing a control chamber, the control chamber is not used to analyze the sample or a derivative thereof, but is used to measure analyte in a separate control or calibrator matrix. The signal in the control chamber may be used for determining background signals (by using a matrix with no analyte), for calibrating the instrument (by using a calibrator matrix with a predetermined amount of analyte to determine calibration parameters) or to determine if the cartridge is functioning properly (by using a control matrix with a predetermined amount of analyte and determining if the signal falls within a predetermined acceptable range).

[0226] The cartridge fluidics may include bubble traps. The bubble trap is a chamber or conduit adapted for removing bubbles from fluid streams. Preferably, there is a bubble trap between the sample and detection chambers so that bubbles in the sample may be removed prior to introducing the sample into the detection chamber. FIG. **31** shows a cross-sectional view of one exemplary embodiment and shows bubble trap chamber **3110** connected to inlet conduit **3140** and outlet conduit **3145** (the inlet and outlet conduits being, preferably, located near the bottom of chamber **3110**) and vent port **3150**. Liquid is introduced into chamber **3110** via inlet **3140**. Chamber **3110** is, preferably, wide enough so that bubbles in a